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**Number 2**

## **TECHNICAL NOTE**

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### **Introducing Stabilant 22, the Electronic Contact Enhancer**

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#### **Introducing Stabilant 22**

Stabilant 22 is a contact enhancer for electrical and electronic connectors and switches. It is a liquid polymer (a polyglycol) that forms a protective coating on contact surfaces and enhances the conductivity of the metal to metal contact area. It remains nonconductive except in the microscopic spaces between the contact surfaces, where an electric field gradient allows it to conduct, reducing the overall contact resistance. Stabilant 22 mitigates corrosion and wear problems by a combination of its electrical properties, surfactant action and lubrication ability, providing a single component resident solution to virtually all contact problems.

*When applied to electromechanical contacts, Stabilant 22 provides the connection reliability of a soldered joint without bonding the contact surfaces together.*

Stabilant products include the concentrate (just Stabilant 22) and alcohol diluted products, Stabilant 22A (with isopropanol), and Stabilant 22E (with ethanol). Each is convenient for particular methods of application, as we describe later.

This Technical Note outlines the properties and uses of Stabilant 22 products, answering some of the most common questions. Further information is found in our Application Notes, the first of which similarly introduces Stabilant products and their wide range of uses. Physical and chemical data for Stabilant formulations are published in our Safety Data Sheets, which are available on request.

#### **Where is Stabilant 22 used?**

Stabilant 22 can be used wherever electrical contacts are used. It works on circuits using DC or AC frequencies up to several gigahertz. Customers have successfully used Stabilant 22 with currents from nanoamps to hundreds of amps and voltages from small signals to hundreds of volts (with special precautions over 100V). Applications include audio/visual, automotive, avionics, batteries, biomedical, cameras, communications, computing, construction, farming, lighting, locomotive, marine, manufacturing, military, mining, robotics, security, and many more.

## How does Stabilant 22 work?

Contact failure is rarely caused by a single factor. Treatments that solve only one problem only offer partial or temporary solutions. For example, cleaners, lubricants and corrosion inhibitors can be used separately or in some combination, but Stabilant 22 addresses the relevant challenges in one convenient treatment. Simple cleaners do not prevent the return of corrosive influences - they must be used each time a connector gets dirty. Corrosion inhibitors are often specific to one type of metal or plating. While modern dielectric greases address corrosion and fretting of contacts, caution is required in their selection - unsaturated oils used in older contact treatments can *varnish*, as they cross-link under the influence of catalytic contaminants.

Once applied to contact surfaces, Stabilant 22 will prevent the entry of outside contaminants. It has sufficient surfactant action to lift surface contaminants and hold them in suspension. In cases where corrosion products are thus kept off of the metal surface, Stabilant 22 will prevent rectification effects (one cause of signal distortion).

The contact enhancement function of Stabilant 22 can be understood by taking a microscopic view of a contact interface. A visibly smooth electrical contact has some roughness – a landscape of hills and valleys. True metal to metal contact is made where the high spots on either contact face (technically *asperities*) contact the other side.

An electric circuit model of this would be a large array of parallel tiny resistances – these allow various current flows that amount to a single contact resistance in the range of milliohms. In an untreated contact pair, tiny gaps also exist that are filled by air, and unfortunately, any available contaminants.

Stabilant fills those spaces, while allowing those contacting spots to remain undisturbed. Immediately next to each of those contact points, the distance from metal to metal goes from a few nanometres to perhaps micrometres in the larger gaps. In this area, Stabilant facilitates additional conduction by quantum tunneling – a further parallel resistive contact that lowers the overall resistance of the contact pair. Finally, in the largest gaps, the high dielectric constant of Stabilant 22 forms a capacitive layer in parallel with the resistive microcontacts, yielding an additional advantage in the passage of AC signals. Again, all of these effects contribute to improved low resistance contacts and longer service life.

## Is Stabilant 22 cost effective?

Stabilant 22 can be quickly applied to all contacts and connectors in a system, in some cases allowing the elimination of difficult diagnosis of which one of the many contacts are erratic. This can significantly reduce service time in the field and in many cases eliminates the need to return boards for shop service or remanufacturing.

As any service manager knows, the diagnosis of electronic problems, especially where intermittent failures are concerned, is more difficult than the actual part replacement, often requiring service personnel of exceptional caliber. The use of Stabilant 22 can thus increase the efficiency of existing staff as well as allowing many connector harness related problems to be handled at a much lower cost – many users have reported savings of hundreds of dollars as a result of Stabilant treatment costing just a few dollars.

In many electronic applications, unintended demodulation (detection) of RF signals in connectors exhibiting thin film rectification effects can either reduce the signal-to-noise ratio or introduce artifacts which can disrupt data flow. Stabilant 22 can cure these problems, cutting costs in both shop and field maintenance. In manufacturing of electronic systems, this can speed up production and reduce rejections.

### **In what forms is Stabilant available?**

As previously mentioned, Stabilant 22 is available in its concentrated form (just called *Stabilant 22*), and in two alcohol diluted products: Stabilant 22A is diluted with isopropyl alcohol and Stabilant 22E uses ethanol (both are 75% alcohol by volume). While we ship only these formulations, end users can choose to dilute the concentrate 4:1, 5:1, or even further based upon needs of application.

A unique packaging, Stabilant 22S, includes a 50mL bottle about one fourth filled with the concentrate. The bottle includes label marks to top up with alcohol to the equivalent concentration of Stabilant 22A, but the end user decides what type and how much diluent to add to the container. This product is easier to ship, as one avoids any concern about the *hazardous materials* aspect of alcohols.

Our most popular product is the Stabilant 22A 15mL Service Kit. It consists of a 15mL dropper bottle of Stabilant 22A and some microbrush applicators, all in a small capped cardboard tube. This was developed at the request of service technicians, who needed something convenient to toss into a toolbox with no worry of leaks or damage. Similar service kits are available for other sizes.

Stabilant 22 is packaged in 5mL, 15 mL, 50mL and 100mL containers – 250mL, 500mL and 1L bottles are available by special order. The 5mL 15mL and 50mL sizes are in dropper bottles. The diluted versions, Stabilant 22A/22E are in 15mL dropper bottles. Many manufacturers and service organizations make large volume purchases, diluting the material for specific applications used in their production lines or shops. Special orders of 250mL, 500mL and 1 Liter containers may be available upon request.

For some companies using Stabilant 22/22A as a stock store item, we produce labels with customized part or stock numbers. Custom labeling has been provided for many manufacturers who wish to assign their own stock control number, or to distributors who wish to market the product under their own logo. Obviously, this requires purchase of the product in suitable quantities.

Special ordering information is available by contacting D.W. Electrochemicals or one of our distributors.

### **What is the difference in use of Stabilant 22A vs. Stabilant 22 concentrate?**

Stabilant 22 (concentrate) is most useful where the connections are openly accessible, such as card edge connectors or where one would prioritize the lubricating property of the material - such as an aid to installing socketed IC's or on switches. Where the connections are not too easy to get at or where the user wishes to apply the material to something such as a socketed IC (without removing the IC from its socket), it is easier to use the alcohol diluted form (Stabilant 22A or 22E). The alcohol diluent serves to carry the concentrate into the connector and evaporates quickly under service conditions.

## How much should be used?

Normally, a very small amount is needed. A final film thickness of from 1 to 2 mils (please note mils refers to 1/1000 of an inch or .0254 mm) is all that is necessary. In other words, you want just enough to fill up the interstices between the contact's faces. When using Stabilant 22A/22E, you'll have to use enough so that once the isopropyl alcohol or ethanol evaporates, the desired 1 to 2 mil film of Stabilant 22 remains.

In applications to moving surfaces, such as in slip rings or potentiometers, film thickness should be minimized to the point where "hydroplaning" won't occur.

## What is the best way to apply Stabilant to contacts?

Stabilant 22 or 22A can be applied in several ways. Inside each Service Kit we include anywhere from 3 to 10 microbrushes depending on the size of bottle you purchase. We recommend putting a drop on the microbrush and then painting that drop on to the male and/or female contacts.

The dropper tips allow the liquid to be dropped onto the microbrush or directly onto/around components such as socketed IC's, switches, connectors, etc. Cards can also have their edge connectors dipped into the dilute material.

## How can I be sure that Stabilant works?

The reliability of Stabilant 22 has been demonstrated in many industries, in many types of equipment. This includes equipment whose failure can cost lives; equipment such as biomedical electronics in hospitals, as well as aircraft navigation, instrument landing systems and air traffic control. Other areas with critical reliability concerns include pulp and paper mills, oil fields, mining, railway operations, diving, marine electronics, and air traffic control. Stabilant's long shelf life and long service life (reported by some customers to exceed 10 years) result from its chemical stability and non-volatile nature. Its proven effectiveness in the prevention of system malfunctions has led many manufacturers to specify the use of this material in preventive maintenance programs.

In our early years, presenting Stabilant 22 at trade shows, we demonstrated the safety of application to computer systems with a visually striking exhibit: A computer motherboard was operated while immersed in a clear plexiglas case, partially filled with Stabilant 22 and connected to the keyboard, display, etc. – as pictured (right), this included a controller for a flight simulator program. This demonstration was quite effective in dispelling doubts about Stabilant's ability to function while NOT creating any short circuit between the computer's closely spaced adjacent contacts.



That said, we still advise that the best way to find out just how well it works is to try it on your own choice of equipment. (We provide samples for testing if requested and approved by us). Almost every service shop or manufacturer has equipment available where the switches or connectors have become erratic over the years. Use Stabilant 22/22A/22E on them and satisfy yourself.

We recommend testing on your most challenging assortment of connectors that are corroded, or dirty or just plain unreliable. This way, the benefit of Stabilant 22 will be seen quickly – in contrast to the long waiting time to see the improved service life of connectors that are treated when brand new.

### **Is Stabilant hazardous to use?**

Stabilant 22 has very low oral toxicity, though ingestion should be avoided. Under normal workplace conditions no skin sensitization effects have been noted. In the undiluted form, it is non-flammable although if heated above 200° Celsius the decomposition products would burn. And Stabilants are environmentally friendly materials. Please note that when using the diluted product (Stabilant 22A or 22E), fire safety precautions apply to the small quantity of alcohol being used.

No special training is required to use Stabilant products – thousands of applications of the consumer version of Stabilant 22 have been made over a period of 30 years now without any reported problems. We still advise all users to become familiar with the product by reading the Safety Data Sheets, Application Notes and Technical Notes as needed. We provide these on request and many are available for download from our website (see contact information at the top of this Note).

### **Is it available in a spray can?**

We have not marketed Stabilant 22 products in spray cans for two reasons. Spraying typically wastes the material, leaving the user a job of cleaning up.

With an intention to be environmentally responsible and safety conscious, we ruled out the use of either a chlorofluorocarbon or a highly flammable mixture of butane and propane as a propellant. As newer propellants become available, we will evaluate the possibility of introducing new dispenser styles.

It is noteworthy that the solvent impact of Stabilant 22A (the isopropanol diluted product) is only about 1/200th that of conventional contact cleaning solvents over a three-year time span. As Stabilant 22 contains no solvent it has absolutely minimal environmental impact and is, therefore, becoming the treatment of choice for many service organizations.

### **Where are Stabilant products available?**

D.W. Electrochemicals Ltd. manufactures Stabilant products in Canada and sells through a network of distributors around the world. A list is available on our website or by contacting us (address, phone and email above).

***NATO Identification for military procurement***

CAGE (NATO Supplier Code) for D.W. Electrochemicals Ltd: 38948

<b>Product Name</b>	<b>NATO Stock Number (NSN)</b>
5mL Stabilant 22 (Concentrate)	5999-20-002-1112
15mL Stabilant 22 (Concentrate)	5999-21-909-9981
15mL Stabilant 22A (Isopropanol Diluted)	5999-21-900-6937
15mL Stabilant 22E (Ethanol Diluted)	5999-21-909-9984

Stabilant products are patented. Because the patents cover contacts treated with the material a Point-of-Sale license is granted with each sale of the material.

**SAFETY DATA SHEETS ARE AVAILABLE ON REQUEST**

**NOTICE**

This data has been supplied for information purposes only. While to our knowledge it is accurate, users should determine the suitability of the material for their application by running their own tests. Neither D.W. Electrochemicals Ltd., their distributors, or their dealers assume any responsibility or liability for damages to equipment and/or consequent damages, howsoever caused, based on the use of this information. This note is based on the work of William M. Wright, updated by D.W. Staff, including suggestions from our customers.

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